taken from the caves with block and tackle. It had to be first lifted from ledge to ledge and then taken out. It is not thought best to make the opening larger as it might interfere with the freezing. A photograph of the inside is not easily taken, and there are none in Flagstaff, though it would be possible to take one by flashlight. A photograph of the outside would convey no idea whatever as it is merely a pile of rocks, and was found by accident.

OBSERVATIONS AT HONOLULU.

Through the kind cooperation of Mr. Curtis J. Lyons, Meteorologist to the Government Survey, the monthly report of meteorological conditions at Honolulu is now made partly in accordance with the new form, No. 1040, and the arrangement of the columns, therefore, differs from those previously published.

Meteorological Observations at Honolulu, February, 1901.

The station is at 21° 18′ N., 157° 50′ W.

Hawaiian standard time is $10^h 30^m$ slow of Greenwich time. Honolulu local mean time is $10^h 31^m$ slow of Greenwich.

Pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet, and the barometer 50 feet above sea level.

Date.	Pressure at sea level.	Temperature. Dry bulb.	Temperature. Wet bulb.	During twenty-four hours preceding 1 p. m., Greenwich time, or 2.29 a. m., Honolulu time. Temperature. Maximum.	Temperature. Minimum.	Means. Dew-point.	Means. Relative humidity.	Wind. Prevailing direction.	Wind. Force.	Average cloudiness.	Sea-level pressures. Maximum.	Sea-level pressures. Minimum.	Total rainfall at 9 a. m., local time.
	*	†	†			‡	‡		§				
1	29.90	65	57	75	61	60.7	77	w-ne.	1-3	8-0	29.93	29 85	0.03
2	29.90	59	57	73	61	54.3	64	n-sw.	1-0	0	29.93	29.83	0.00
3	29.86	68	64	77	57	60.5	78	s-ne.	1	1-10	29.94	29.84	0.00
4	29.66	70	64	76	67	60.7	71	nne.	2-4	10	29.89	29.60	0.32
5	29.53	70	67.5	75	65	62.3	70	se-e	5	10-8	29.67	29.52	0.09
6	29.51	69	67	76	68	66.7	84	ss -s.	5-4	10	29.59	29.48	0.53
7	29.58	68	66.7	75	66	67.3	85	ssw-sw.	6-4	9-10	29.57	29.48	1.01
8	29.61	67	65.7	75	66	66.8	89	sw-n.	3-1	10-3	29.68	29.56	1.00
9	29.66	72	64	72	65	65.7	92	sw-w.	2-0	10-7	29.71	29.63	0.30
10	29.62	69	67 5	77	70	62.3	69	sw.	4-2	2-7	29.72	29.62	0.27
11	29.66	71	69.7	77	65	68.3	88	sw-w.	3	10-7	29.69	29.60	0.73
12	29.74	72	68.5	77	69	67.7	85	sw.	3	5-10	29.73	29.68	0.06
13	29.72	71	69.7	73	70	68.3	89	w.	0-1	10	29.82	29.72	2.87
14	29.82	61	58.5	72	68	65.7	92	w-n.	1	10	29.85	29.70	0.54
15	29.93	65	59	73	60	58.3	80	sw-ne.	1	5-1	29.96	29 81	0.05
16	30.08	67	58	74	60	55.3	62	nne.	1-4	4	30.05	29.94	0.04
17	30.09	65	58.5	73	65	57.7	68	ne.	3	6	30.11	30.02	0.02
18	29.98	56	54	72	64	53.5	60	nne.	4-5	1 0	30.11	30.02	0.00
19	29.89	58	57.3	74	55	55.3	73	sw.	0-1	1-5	30.04	29.89	0.00
20	29.80	63	61	77	57	60.3	81	w.	3	4	29.92	29.80	0.00
21	29.81	62	58	77	58	62.3	77	wnw.	4	4	29.86	29.75	0.05
22	29.91	56	54	73	59	54.7	70	nw.	3-1	4-1	29.95	29.80	0 00
23	29.85	68	62.5	73	54	53.5	67	n-s.	1-0	2	29.96	29.84	0.04
24	30.03	56	54.5	75	64	58.7	71	wsw.	2-0	8-0	30.04	29.86	0.01
25	30.03	58	57	75	55	56.0	72	sw-n.	1-0	1-3	30.09	30.00	0.00
26	29.94	64	62.7	76	56	60.3	70	se-sw.	1-0	1-3	30.04	29.93	0.00
27	29.93	64	62.7	78	63	65.0	81	sw.	2-0	1-6	29.99	29.89	0.00
28	30.04	67	64	78	64	63.8	76	sw-ne.	1-3	1-8	30.08	29.91	0.00
Sums.	......	......	......	......	......	......	......	......	......	......	......	......	7.96
Means.	29.822	65.0	61.8	75.0	62.7	61.6	76.5	....	2.2	5.3	29.890	29.792	.....
Departure.	—.109	......	......	......	......	—1.0	+1.6	....	.....	.....	......	......	+2.00

Mean temperature for February, 1901 (6+2+9) ÷ 3 = 68.7; normal is 70.4. Mean pressure for February, 1901 (9+3) ÷ 2 = 29.838; normal is 29.947.

*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡These values are the means of (6+9+2+9) ÷ 4. §Beaufort scale.

Mean pressure lowest in twenty years. Mean temperature lowest for February with one exception. General electric storms throughout the group from the 4th to 15th probably came from the south-southwest, during which time the barometer fell to the lowest point reached in twenty years. Very heavy rains and snow fell on the mountains.

MEXICAN CLIMATOLOGICAL DATA.

Through the kind cooperation of Señor Manuel E. Pastrana, Director of the Central Meteorologic-Magnetic Observatory, the monthly summaries of Mexican data are now communicated in manuscript, in advance of their publication in the Boletin Mensual. An abstract, translated into English measures, is here given, in continuation of the similar tables published in the MONTHLY WEATHER REVIEW since 1896. The barometric means have not been reduced to standard gravity, but this correction will be given at some future date when the pressures are published on our Chart IV.

Mexican data for February, 1901.

Stations.	Altitude.	Mean barometer.	Temperature. Max.	Temperature. Min.	Temperature. Mean.	Relative humidity.	Precipitation.	Prevailing direction. Wind.	Prevailing direction. Cloud.
	Feet.	*Inch.*	° *F.*	° *F.*	° *F.*	%	*Inch.*		
Chihuahua	4,669	25.30	69.3	33.4	51.4	59	0.16	sw.	w.
Durango (Seminario)	6,243	24.02	84.4	29.3	54.9	44	0.24	sw.	w.
Leon (Guanajuato)	5,934	24.31	78.8	37.6	58 5	52	0.63	nw.	sw.
Linares (Nuevo Leon)	1,188	28.75	87.8	35.6	61.5	66	0.24	n.	s.
Mazatlan	25	29.98	79.0	60.3	70.3	77	0.88	nw.	w.
Mexico (Obs. Cent.)	7,472	23.06	72.7	34 2	57.2	48	0.99	n.	....
Morelia (Seminario)	6,401	23.98	74.7	33 8	55.6	58	1.50	s.	w.
Puebla (Col. Cat.)	7,112	23.39	73.8	41.9	58.8	54	0.87	e.	sw.
Saltillo (Col. S. Juan)	5,399	24 79	75.2	33 8	55.9	66	0.47	s.	s.
San Luis Potosi	6,202	24.11	75.6	41.0	58.6	61	1.09	sw.	w.
Tampico	38	....	......	......	....	......	......	....	....
Zapotlan (Seminario)	5,078	25.11	81.0	38.5	61.0	53	1.50	sse.	w.

RELATIVE LENGTH OF WARM AND COLD SEASONS.

By HENRY PENNYWITT, dated February 20, 1901.

Charts XI, XII, and XIII have been prepared with the view of determining approximately the length of the warm and cold seasons in various locations, by comparing the daily normal temperatures in spring and autumn with the annual means as computed from records for twenty-five years or less of 135 Weather Bureau stations between 1872 and 1898.

The dates on which the daily normal temperatures in spring equal the annual mean vary according to locality. In the upward progress the daily normals first overtake the annual in the Northwest, in the region including the greater portion of Texas and portions of Arkansas, Oklahoma, and Kansas, where the dates range from about the 5th to the 10th of April; in the Mississippi Valley the dates range from the 10th to the 15th of April; in the region extending from the east Gulf States northward to the Ohio Valley, including the eastern portions of Wisconsin and Illinois, all of Indiana, the most of Ohio, and portions of Pennsylvania and New York, the dates fall between the 15th and 20th of April; in the greater portion of the upper Lake region and in a strip near the Atlantic coast between the 20th and 25th of April; along the middle Atlantic coast and in the lower Lake region after the 25th of April; in the region including western Colorado, Utah, portions of Nevada, New Mexico and Arizona, and in southern California, they occur much later, as late as the 1st to 10th of May in the region last named.

In the autumn, when the temperatures are declining, the daily normals first coincide with the annual mean in the Ohio Valley and Gulf States and in the southern slope of the Rocky Mountain region, where this occurs before the 20th of October; along the Atlantic coast about the 25th of October; along the Pacific coast it occurs after the 1st of November, the latest date being in the vicinity of San Francisco, Cal., or about the 20th of November.

If the year be divided into two seasons, the warm and the cold season (the warm season including the time when the daily normals are above the annual mean and the cold season when they are below), it is found that in the greater portion of the United States the warm season is longer than the cold, the exceptions being in the southern slope of the Rocky Mountain region and in small areas in the lower Lake region and Middle Atlantic States. The longest warm season is in the northwest and on the middle California coast, where it exceeds the cold season in length of time by from 30 to 50 days. The longest cold season is to be found in the southern slope of the Rocky Mountain region, where the cold exceeds the warm season by about 10 days.

The warm season in Texas and the lower Missouri Valley opens about 10 days earlier than in the region near the Atlantic coast south of the lower Lake region, and from 20 to 25 days earlier than on the southern coast of California, while in the northwest it opens from 20 to 25 days earlier than in the Lake region, and from 15 to 20 days earlier than in the northern Pacific coast region.

There does not appear to be such decided differences in the dates of the setting in of the cold season, except along the Pacific coast, where the coincidence of daily normal and annual mean is delayed much later than over the rest of the country.

THE RAINFALL OF THE LEEWARD AND WINDWARD ISLANDS.

By MARK S. W. JEFFERSON, Elmwood, Mass., Submaster Brockton High School.

Mr. Alexander's notes on the rainfall of St. Kitts, W. I., in the MONTHLY WEATHER REVIEW for November, 1900 are of great interest. I am moved to wonder how far the observations given represent the moisture conditions of the island. During a month down and up the Leeward and Windward islands as far as Trinidad, in 1895, with rambles ashore daily, I learned to regard the inner islands, St. Kitts, Nevis, Montserrat, Guadeloupe, etc., to St. Vincent, as heavily wooded mountain summits with abundant rains, due largely to the elevation to which the trades must rise to pass over them. St. Kitts is one of the northernmost and least luxuriant, yet the woods above Basseterre are difficult to penetrate. On the more southern islands the forests are primeval and quite impenetrable. I have before me a number of photographs of these woods as I write, especially in Dominica and St. Kitts, Antigua, and Barbados. On the other hand I recall as dry clear sky islands to the eastward of the main line, without the high peaks and their cloud curtain, and their open woodless country is associated in my mind with lesser altitude.

The inner islands, while rarely thirty miles in length, are all surmounted by peaks well toward a mile in height, and all through the month of March, 1895, showers chased each other across their slopes, or clouds trailed out from their summits. These appearances are abundantly recorded in chance photographs. The rank forest growth forbids the assumption of an unusual month, while the massive stone arches of the highway bridges everywhere, with the peculiar torrent-paving and rainstorm-bridges of Nevis and St. Kitts, imply violent downpours on occasion. I do not know how many of these pavements there may be in St. Kitts, but I stumbled at once on two of them, one at Old Roads, or on the way thither, and the other I have forgotten where. Of the first I have a photograph before me. They are simply portions of the highway paved with stone blocks where mountain torrents pass in time of showers. At the date of my passing they were without water. Two views of rain bridges are in my collection, one at Old Roads, a stone arch ascended by steps at each end, and furnished with a handrail, while a thin stream of water flowed beneath; the other, at Nevis, has steps and round piers of stone with a footway of planks overhead; beneath this no water. I do not remember who told me these bridges were provisions against storms, but I think I was so told, and the fact seemed sufficiently obvious.

Antigua and Barbados, on the contrary, are but 1,300 to to 1,600 feet in height; they are dusty, sunny, and open. Numerous drives assure one that forests either do not exist or are very remote from Georgetown and St. Johns, while there is in both islands a complete absence of that weed tangle, in neglected corners, characteristic of the rain belt. I have supposed that the amount of cooling from expansion induced by this moderate ascent did not induce the trades to give up so much of their moisture. It is my impression that the English regard these two islands as the most agreeable and healthful for residence, not that they are arid but of moderate moisture.

These facts are not at all incompatible with the precipitation figures Mr. Alexander cites, but may, perhaps, be useful to supplement them. What they seem to suggest is that the coastal fringe of plain—an old sea bottom on which Brimstone Hill was a coral reef—receives a rainfall of from 50 to 70 inches, while the mountains above receive a much greater quantity. The constant clouding of Mount Misery compels this belief and all analogy supports it. It is a common defect of rainfall measurements in uneven country that they refer, necessarily, to the low levels inhabited by men. F. H. Newell, in his report on Stream Measurements in 1897, on page 501, cites Cedar River, Washington, as showing:

> A run off of over 102 inches, when compared with the probable precipitation of something over 90 inches at Northbend, which indicates that there must be a considerable increase of precipitation on the mountain slopes, Mr. Noble thinks that the precipitation near the summit of the mountain must be as much as 150 inches a year.

Similarly it is possible that Mount Misery may receive considerably more than 100 inches a year. It will be seen that the steady trades will drive this rainfall toward Brothersons and give to it the greatest precipitation of the island. Similarly the wind tends to keep the mountain downfall away from the east side and diminish its record. For the same reason the west side has nearly as great a fall as the north, the difference being presumably due to the fact that the mountains descend to the southeast of Mount Misery. It is to be noted that the brief record of four months at the Fountain estate, only 800 feet, shows a precipitation twice as great as at Bassetere; also, that the visitor to the summit found the same mist cap there (Table 5) which so impressed me on all these inner islands.

The table of comparative rainfall on four Leeward Islands, on page 488, might convey the idea that Antigua, Nevis, and St. Kitts receive about the same amount of rain. It is my belief that in quantity of water received by the square mile, they are very different. The plants appear to show this. A heavy precipitation on the mountains must of course go to maintain the ground water of the coastal plains and make possible a cultivation that would be difficult without it. The possession of the coastal plain in which St. Kitts differs from Montserrat, Dominica, etc., may give it the advantage for human dwelling of lesser humidity. A complete account of any climate would include necessarily measures of vegetable transpiration, direct evaporation and ground water; and (lacking measures) general statements about plant life may be important qualifiers of rainfall figures.

On reference to Mr. Alexander's note on the great flood of January, 1880, in the REVIEW for May, 1899, I note that although the observers impute the flood to a fall of 20 to 36 inches (estimated) of rain, the authorities who built the wall, like those who constructed torrent pavements and bridges, looked to heavy precipitation on the mountains for their danger.

Hellmann's studies on rainfall measurements about Berlin are suggestive of limits to the dependence to be placed on the St. Kitts gages, yet, the simple prevalence of an easterly wind laden with moisture from the ocean explains admirably the results observed. As the hills east of Basseterre are low, we may group the south and east side as being to windward of low and high mountains, respectively, while the west and north